IN THE CLAIMS:

Claims 1 and 26 have been amended herein. Please note that all claims currently pending and under consideration in the referenced application are shown below. Please enter these claims as amended. This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently amended) An instrumented pin member, comprising:

a pin member body disposed about a pin member axis, the pin member body comprising a bending portion;

a sensing device positioned at the pin member body within the bending portion having a plurality of sensor elements configured in an arrangement for sensing a bending strain in the bending portion exclusive of a net axial strain, and for outputting a sensor measurement signal representative of the bending strain; and

a sensor measurement signal output device for outputting the sensor measurement signal from the sensing device.

2. (Previously presented) The instrumented pin member as recited in claim 1, wherein the sensing device senses components of the bending strain in the bending portion along an x axis and a y axis, the x axis and the y axis being orthogonal to the pin member axis and to each other.

3. (Previously presented) The instrumented pin member as recited in claim 1, wherein the pin member body comprises a bolt.

4. (Previously presented) The instrumented pin member as recited in claim 1, wherein the pin member body has a cylindrical shape about the pin member axis.

5. (Previously presented) The instrumented pin member as recited in claim 1, wherein:
the pin member body comprises a head; and
the bending portion is adjacent to the head.

6. (Previously presented) The instrumented pin member as recited in claim 1, wherein the sensing device comprises:
first and second x axis sensor elements for measuring the bending strain along an x axis; and
first and second y axis sensor elements for measuring the bending strain along a y axis.

7. (Previously presented) The instrumented pin member as recited in claim 6, wherein each of the first and second x axis sensor elements comprises an axial sensor for sensing strain in a pin member axial direction corresponding to the pin member axis.

8. (Previously presented) The instrumented pin member as recited in claim 6, wherein:
the pin member body comprises a shank including a shank perimeter lying in a plane orthogonal to the pin member axis; and
each of the first and second x axis sensor elements comprises a tangential sensor for sensing strain in a direction tangential to the shank perimeter.

9. (Previously presented) The instrumented pin member as recited in claim 6, wherein each of the first and second y axis sensor elements comprises an axial sensor for sensing strain in a pin member axial direction corresponding to the pin member axis.

10. (Previously presented) The instrumented pin member as recited in claim 6, wherein:

the pin member body comprises a shank including a shank perimeter lying in a plane orthogonal to the pin member axis; and

each of the first and second y axis sensor elements comprises a tangential sensor for sensing strain in a direction tangential to the shank perimeter.

11. (Previously presented) The instrumented pin member as recited in claim 6, wherein:

each of the first and second x axis sensor elements and each of the first and second y axis sensor elements comprises an axial sensor for sensing strain in a pin member axial direction corresponding to the pin member axis;

the pin member body comprises a shank including a shank perimeter lying in a plane orthogonal to the pin member axis; and

each of the first and second x axis sensor elements and each of the first and second y axis sensor elements comprises a tangential sensor for sensing strain in a direction tangential to the shank perimeter.

12. (Previously presented) The instrumented pin member as recited in claim 7, wherein the sensing device further comprises:

an x axis bridge having a left side and a right side, the left x axis bridge side comprising first and second positions and the right x axis bridge side comprising first and second positions;

the first position of the left x axis bridge side and the first position of the right x axis bridge side being in a first aligned x axis configuration; and

the second position of the left x axis bridge side and the second position of the right x axis bridge side being in a second aligned x axis configuration, the axial sensors of the first and second x axis sensor elements being in one of the first aligned x axis configuration and the second aligned x axis configuration.

13. (Previously presented) The instrumented pin member as recited in claim 7, wherein the sensing device further comprises:

an x axis bridge having a left side and a right side, the left x axis bridge side comprising first and second positions and the right x axis bridge side comprising first and second positions;

the first position of the left x axis bridge side and the first position of the right x axis bridge side being in a first aligned x axis configuration; and

the second position of the left x axis bridge side and the second position of the right x axis bridge side being in a second aligned x axis configuration; and

an axial stress measurement configuration and a bending stress measurement configuration, the sensing device being in the bending stress measurement mode when the axial sensors of the first and second x axis sensor elements are in one of the first aligned x axis configuration and the second aligned x axis configuration.

14. (Previously presented) The instrumented pin member as recited in claim 13, wherein the sensing device is in the axial stress measurement configuration when the axial sensors of the first and second x axis sensor elements are not in one of the first aligned x axis configuration and the second aligned x axis configuration.

15. (Previously presented) The instrumented pin member as recited in claim 8, wherein: the sensing device comprises:

an x axis bridge having a left side and a right side, the left x axis bridge side comprising first and second positions and the right x axis bridge side comprising first and second positions;

the first position of the left x axis bridge side and the first position of the right x axis bridge side being in a first aligned x axis configuration; and

the second position of the left x axis bridge side and the second position of the right x axis bridge side being in a second aligned x axis configuration;

the tangential sensors of the first and second x axis sensor elements being in one of the first aligned x axis configuration and the second aligned x axis configuration.

16. (Previously presented) The instrumented pin member as recited in claim 11, wherein the sensing device comprises:

an x axis bridge having a left side and a right side, the left x axis bridge side comprising first and second positions and the right x axis bridge side comprising first and second positions;

the first position of the left x axis bridge side and the first position of the right x axis bridge side being in a first aligned x axis configuration; and

the second position of the left x axis bridge side and the second position of the right x axis bridge side being in a second aligned x axis configuration; and

an axial stress measurement configuration and a bending stress measurement configuration, the sensing device being in the bending stress measurement configuration when the tangential sensors of the first and second x axis sensor elements are in one of the first aligned x axis configuration and the second aligned x axis configuration.

17. (Previously presented) The instrumented pin member as recited in claim 16, wherein the sensing device is in the axial stress measurement configuration when the tangential sensors of the first and second x axis sensor elements are not in one of the first aligned x axis configuration and the second aligned x axis configuration.

18. (Previously presented) The instrumented pin member as recited in claim 9, wherein the sensing device comprises:

a y axis bridge having a left side and a right side, the left y axis bridge side comprising first and second positions and the right y axis bridge side comprising first and second positions;

the first position of the left y axis bridge side and the first position of the right y axis bridge side being in a first aligned y axis configuration; and

the second position of the left y axis bridge side and the second position of the right y axis bridge side being in a second aligned y axis configuration;

the axial sensors of the first and second y axis sensor elements being in one of the first aligned y axis configuration and the second aligned y axis configuration.

19. (Previously presented) The instrumented pin member as recited in claim 18, wherein the sensing device further comprises:

an axial stress measurement configuration and a bending stress measurement configuration, the sensing device being in the bending stress measurement configuration when the axial sensors of the first and second y axis sensor elements are in one of the first aligned y axis configuration and the second aligned y axis configuration.

20. (Previously presented) The instrumented pin member as recited in claim 19, wherein the sensing device is in the axial stress measurement configuration when the axial sensors of the first and second y axis sensor elements are not in one of the first aligned y axis configuration and the second aligned y axis configuration.

21. (Previously presented) The instrumented pin member as recited in claim 10, wherein the sensing device further comprises:

a y axis bridge having a left side and a right side, the left y axis bridge side comprising first and second positions and the right y axis bridge side comprising first and second positions;

the first position of the left y axis bridge side and the first position of the right y axis bridge side being in a first aligned y axis configuration; and

the second position of the left y axis bridge side and the second position of the right y axis bridge side being in a second aligned y axis configuration;

the tangential sensors of the first and second y axis sensor elements being in one of the first aligned y axis configuration and the second aligned y axis configuration.

22. (Previously presented) The instrumented pin member as recited in claim 21, wherein the sensing device further comprises:

an axial stress measurement configuration and a bending stress measurement configuration, the sensing device being in the bending stress measurement configuration when the axial sensors of the first and second y axis sensor elements are in one of the first aligned y axis configuration and the second aligned y axis configuration.

23. (Previously presented) The instrumented pin member as recited in claim 22, wherein the sensing device is in the axial stress measurement configuration when the axial sensors of the first and second y axis sensor elements are not in one of the first aligned y axis configuration and the second aligned y axis configuration.

24. (Previously presented) The instrumented pin member as recited in claim 11, wherein the sensing device further comprises:

an x axis bridge having a left side and a right side, the left x axis bridge side comprising first and second positions and the right x axis bridge side comprising first and second positions;

the first position of the left x axis bridge side and the first position of the right x axis bridge side being in a first aligned x axis configuration; and

the second position of the left x axis bridge side and the second position of the right x axis bridge side being in a second aligned x axis configuration;

the axial sensors of the first and second x axis sensor elements being in one of the first aligned x axis configuration and the second aligned x axis configuration, and the tangential sensors of the first and second x axis sensor elements being in the other of the first aligned x axis configuration and the second aligned x axis configuration; and

a y axis bridge having a left side and a right side, the left y axis bridge side comprising first and second positions and the right y axis bridge side comprising first and second positions;

the first position of the left y axis bridge side and the first position of the right y axis bridge side being in a first aligned y axis configuration; and

the second position of the left y axis bridge side and the second position of the right y axis bridge side being in a second aligned y axis configuration;

the axial sensors of the first and second y axis sensor elements being in one of the first aligned y axis configuration and the second aligned y axis configuration, and the tangential sensors of the first and second y axis sensor elements being in the other of the first aligned y axis configuration and the second aligned y axis configuration.

25. (Previously presented) The instrumented pin member as recited in claim 1, wherein the sensing device comprises a bridge assembly having an axial stress measurement configuration and a bending stress measurement configuration.

26. (Currently amended) An instrumented pin member, comprising:

a pin member body disposed about a pin member axis, the pin member body comprising a bending portion;

a sensing device positioned at the pin member body within the bending portion for sensing a bending strain in the bending portion exclusive of a net axial strain, and for outputting a sensor measurement signal representative of the bending strain;

a sensor measurement signal output device for outputting the sensor measurement signal from the sensing device; and

~~The instrumented pin member as recited in claim 1, further comprising~~ a switching device operatively coupled to the sensing device for switching between an axial stress measurement configuration and a bending stress measurement configuration.

27. (Previously presented) The instrumented pin member as recited in claim 26, wherein the switching device comprises a solid state switching circuit.

28. (Previously presented) The instrumented pin member as recited in claim 26, wherein:
the pin member comprises a head; and
the switching device is positioned at the pin member head.

29. (Previously presented) The instrumented pin member as recited in claim 28, wherein:
the pin member head includes an external surface and a notch disposed in the external surface; and
the switching device is mounted to the external surface.

30. (Previously presented) The instrumented pin member as recited in claim 26, wherein:
the pin member comprises a head including a head cavity; and
the switching device is positioned at the pin member head cavity.

31. (Previously presented) The instrumented pin member as recited in claim 26, wherein the switching device comprises a periodic switching signal source for providing a periodic switching signal.

32. (Cancelled)

33. (Previously presented) The instrumented pin member as recited in claim 26, wherein:

the sensing device comprises a pair of bridges, each having an axial stress measurement configuration and a bending stress measurement configuration; and

the switching device comprises a switch operatively coupled to the pair of bridges for switching the pair of bridges between the axial stress measurement configuration and the bending stress measurement configuration.

34. (Previously presented) The instrumented pin member as recited in claim 33, wherein the switching device switches the pair of bridges to the bending stress measurement configuration substantially simultaneously.

35. (Original) An instrumented pin member, comprising:

a pin member body disposed about a pin member axis, the pin member body comprising a bending portion;

a sensing device positioned on the pin member body within the bending portion for sensing a bending stress in the bending portion during a bending stress measurement mode and for outputting a sensor measurement signal;

a switching device operatively coupled to the sensing device for switching the sensing device in and out of the bending stress measurement mode; and

a sensor signal output device for communicating the sensor measurement signal.

36. (Withdrawn) A system for measuring bending at a joint, the system comprising:

an instrumented pin member disposed at the joint, the instrumented pin member comprising:

a pin member body disposed about a pin member axis, the pin member body comprising a bending portion;

a sensing device positioned at the pin member body within the bending portion for sensing a bending strain in the bending portion exclusive of a net axial

strain, and for outputting a sensor measurement signal representative of the bending strain; and

a sensor measurement signal output device for outputting the sensor measurement signal from the sensing device; and

a data receiving device operatively coupled to the sensor measurement signal output device for receiving the sensor measurement signal.

37. (Withdrawn) The system as recited in claim 36, wherein the instrumented pin member further comprises a switching device operatively coupled to the sensing device for switching the sensing device in and out of a bending stress mode.

38. (Withdrawn) The system as recited in claim 36, wherein the system further comprises a plurality of the instrumented pin members.

39. (Withdrawn) The system as recited in claim 36, wherein the data receiving device comprises a data processor.

40. (Withdrawn) The system as recited in claim 36, wherein the data receiving device comprises a data display.

41. (Previously presented) A method for measuring bending at a joint, the method comprising:

disposing an instrumented pin member at the joint, the instrumented pin member comprising a pin member body disposed about a pin member axis, the pin member body comprising a bending portion;

sensing a bending strain in the bending portion exclusive of a net axial strain during a bending stress measurement mode and outputting a sensor measurement signal; and

communicating the sensor measurement signal to a data receiving device.

42. (Previously presented) The method as recited in claim 41, wherein the disposing of the instrumented pin member comprises disposing a plurality of instrumented pin members at the joint so that the instrumented pin members are substantially equally spaced about the joint.

43. (Previously presented) The method as recited in claim 41, wherein the sensing includes switching in and out of the bending stress measurement mode.

44. (Withdrawn) An instrumented pin member, comprising:

a pin member body having a perimeter disposed about a pin member axis;

a sensing device positioned on the pin member body having a first sensing configuration for sensing a bending stress in the pin member body exclusive of a net axial stress in the pin member body, and a second sensing configuration for sensing the net axial stress in the pin member body exclusive of the bending stress in the pin member body; and

a switching device operatively coupled to the sensing device for switching the sensing device between the first sensing configuration and the second sensing configuration.

45. (Withdrawn) The instrumented pin member as recited in claim 44, wherein the sensing device is configured to sense components of stress in the pin member body along an x axis and a y axis, the x axis and the y axis being orthogonal to the pin member axis and to each other.

46. (Withdrawn) The instrumented pin member as recited in claim 45, wherein the sensing device further comprises:

first and second x axis sensor elements positioned on the perimeter of the pin member body at points intersected by the x axis; and

first and second y axis sensor elements positioned on the perimeter of the pin member body at points intersected by the y axis.

47. (Withdrawn) The instrumented pin member as recited in claim 46, wherein each of the first and second x axis sensor elements and first and second y axis sensor elements comprises:

a first sensor configured to measure strain in the pin member body in a direction corresponding to the pin member axis; and

a second sensor configured to measure strain in the pin member body in a direction tangential to the perimeter of the pin member body.

48. (Withdrawn) The instrumented pin member as recited in claim 44, wherein the sensing device comprises at least one strain gauge attached to the pin member body.

49. (Withdrawn) The instrumented pin member as recited in claim 48, wherein the at least one strain gauge comprises an plurality of strain gauges forming a Wheatstone bridge circuit.

50. (Withdrawn) A method for measuring stress in a pin member body having a perimeter disposed around a pin member axis, comprising:

operably coupling a sensing device to the pin member body;

operating the sensing device in a first mode to measure a bending stress in the pin member body exclusive of a net axial stress in the pin member body; and

operating the sensing device in a second mode to measure the net axial stress in the pin member body exclusive of the bending stress in the pin member body.

51. (Withdrawn) The method as recited in claim 50, further comprising sensing components of stress in the pin member body along an x axis and a y axis, the x axis and the y axis being orthogonal to the pin member axis and to each other.

52. (Withdrawn) The method as recited in claim 51, wherein sensing components of stress in the pin member body along an x axis and a y axis further comprises:

measuring a strain at a first point on the perimeter of the pin member body intersected by the x axis;

measuring a strain at a second point on the perimeter of the pin member body intersected by the x axis;

measuring a strain at a first point on the perimeter of the pin member body intersected by the y axis; and

measuring a strain at a second point on the perimeter of the pin member body intersected by the y axis.

53. (Withdrawn) The method as recited in claim 52, wherein measuring a strain at each of the points on the perimeter of the pin member body comprises:

measuring a strain in the pin member body in a direction corresponding to the pin member axis; and

measuring a strain in the pin member body in a direction tangential to the perimeter of the pin member body.

54. (Withdrawn) The method as recited in claim 50, wherein operably coupling the sensing device to the pin member body comprises attaching a plurality of strain gauges to the pin member body in a Wheatstone bridge circuit.

55. (Withdrawn) The method as recited in claim 54, further comprising switching between the first mode and the second mode by reversing a polarity of a current passed through at least one strain gauge of the plurality of strain gauges.

56. (Withdrawn) The method as recited in claim 50, further comprising switching the sensing device between the first mode and the second mode with a periodic switching signal.

IN THE DRAWINGS:

The attached sheets of drawings include FIGS. 1 through 15, and reflect the changes made to FIGS. 2, 5, 10, 12, 13, and 15 proposed in the Applicants' Letter to the Chief Draftsman mailed April 11, 2003. These sheets are corrected formal drawings and replace all previous drawing sheets submitted for this application.